Interdisciplinary FIAS Colloquium

Friday, August 1, 2008, 9:00
FIAS, Ruth-Moufang-Str. 1, 60438 Frankfurt am Main
Lecture Hall 0.100

Speaker: **Prof. John McCaskill**, Biomolecular Information Processing, Ruhr University Bochum

Title: **Physics of genetically-programmable self-organizing systems: towards artificial chemical cells for "intelligent" microscopic construction**

Abstract: The benefits of utilizing physical embodiment in computations for information control in robotics have become increasingly clear in the last decade. Likewise, chemical interactions can be used to control computations for the construction or modification of complex material systems. Self-referential control of construction is vital in bootstrapping complex systems, including systems designed for information processing per se, and so self-encoding, self-production and self-replication become key ingredients of generic constructive information processing. In an EU-funded project PACE, we have been exploring the self-organization of natural units for constructive information processing, artificial chemical cells: How to design, self-assemble, support, direct, evolve and control them independently of biological cells. We have introduced electronic microscopic feedback control technology (the omega machine) allowing chemical self-organization to be interfaced with digital electronics, that will enable us to gain pseudo-genetic control of the chemical systems. In the talk, I will illustrate our current understanding of the minimal chemical architecture necessary for bootstrapping life, using (i) simple models of evolvable physical-chemical self-organization, (ii) mesoscale simulation and (iii) electronic-microfluidic experiments. I will finish with a perspective of the road ahead, including the role of artificial cells in future intelligent systems and IT.